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CITIZENS' SATISFACTION WITH MUNICIPAL HYGIENE IN RIJEKA AND POSSIBILITIES FOR IMPROVING MUNICIPAL MANAGEMENT

Abstract: *The aim of this paper is to determine the level of satisfaction of citizens of the city of Rijeka (Republic of Croatia) with the quality of municipal services and to identify opportunities for improving the municipal management. The purpose of the paper is to strengthen the municipal management in the city of Rijeka and the Republic of Croatia. The research was conducted on a sample of N=430 residents of the City of Rijeka, and the collected data are analysing using descriptive and inferential statistical methods. The research confirmed a low level of citizen satisfaction with the city's cleanliness, regardless of gender or professional qualifications. Citizens were equally dissatisfied with both the maintenance hygiene of waste bins and containers and the price of cleaning services, while the waste disposal culture among residents of Rijeka was found to be at a very low level.*

Keywords: *municipal hygiene, municipal management, municipal waste, citizen satisfaction, city of Rijeka*

1. Introduction

Smart waste management, based on the principles of the circular economy, is the foundation of sustainable development of local communities. The City of Rijeka, with its strategic approach and implementation of the "smart management" policy, shows a positive direction in establishing an efficient system of municipal services. Efficient management of the municipal sector is increasingly associated with the new economic paradigm of the circular economy (Geissdoerfer et al., 2017), which is seen as a means to achieve sustainable development goals. The circular model implies the transformation of production and consumption towards systems that enable the extension of the life of products through their repair, renewal and recycling (Crane & Matten, 2010). In this way, the added value of the product is increased and at the same time the amount of waste is reduced.

The research problem of importance for this paper arises from the fact that in the Republic of Croatia for the period from 2004 to 2023, a statistically strong and positive relationship was established between GDP trends and municipal waste generation ($r=0.77$; $p<0.01$). The average annual growth rate of municipal waste in the observed period was 1.69%, while the average annual growth rate of GDP was 1.42% (Pupavac & Pupavac, 2024). During 2024, the amount of municipal waste per capita in the Republic of Croatia increased from 474 kg, as it was in 2023, to 486 kg, which is the highest recorded value since the beginning of systematic monitoring. Although the amount of municipal waste is still below the EU average (513 kg), the trend is worrying. The City of Rijeka, with the production of municipal waste per capita at the national average level, also shows a tendency to increase the amount of waste produced. From the above, it can be concluded that, in the absence of appropriate

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interventions, the amount of municipal waste will continue to grow from year to year. Therefore, it is necessary to implement measures that will achieve the separation of the dynamics of economic growth from the dynamics of municipal waste generation. Systematic recycling of municipal and packaging waste creates the prerequisites for the development and application of effective economic instruments that can contribute to the decoupling of municipal waste generation from GDP growth. This approach also contributes to greater citizen satisfaction with the cleanliness and orderliness of local communities. Smart and planned waste management thus becomes one of the key elements of a sustainable "green" economy, which is based on the rational use of resources, without endangering the environment and future generations (Nasirikhodjaeva et al., 2025).

Communal hygiene directly affects the quality of life of citizens and the appearance of the city. Research on resident satisfaction provides insight into how effective municipal services are and helps identify areas that require improvement. Accordingly, the fundamental research question in this scientific discussion is, To what extent are the citizens of the city of Rijeka satisfied with municipal hygiene in the city and which aspects of services do they recognize as key for improvement?

2. Theoretical framework

The circular economy implies a shift from the linear "take-produce-dispose" model to models of reuse, recycling and sustainable use of resources (Kirchherr et al., 2017). In the context of municipal services, this means reducing the amount of waste, introducing a separate collection system and encouraging active participation of citizens. The European Union, through its directives and action plans (European Commission, 2020), emphasizes the importance of developing a circular economy and sustainable waste management.

2.1. Literature review

The municipal economy encompasses key public services, among which waste management is of particular importance. Its role in the circular economy is reflected in the separation, recycling and reuse of waste, which reduces the burden on the environment and promotes sustainable development. The municipal economy represents a significant economic branch within the overall economy of the Republic of Croatia. According to data from the Croatian Chamber of Economy (HGK), this sector employs approximately 4% of the total number of employees and accounts for around 4% of the total assets of the national economy (HGK, n.d.).

The spectrum of municipal services varies between countries, but also within individual local communities, and is extremely wide. Their organization is primarily based on the territorial principle, given that they are usually related to the specific needs of cities and municipalities. According to Šimović and Rogić Lugarić (2012), the scope of local self-government units includes a number of public services that are of vital importance for the daily life of the population.

An analysis of the available literature indicates multiple interpretations of the concept of municipal services. Examples include the following:

Gatarić (1986) defines municipal services as irreplaceable conditions for the life and work of people in a settlement, encompassing services such as water supply, gas, thermal energy, public transport, maintenance of public lighting, sewage systems, cleanliness and roads.

Klemenčić (1992) views municipal services as service activities that, with appropriate natural conditions, technical infrastructure, qualified workforce and professionally based procedures, offer users an appropriate service.

Antić (2008) describes them as specially arranged activities of predominantly service character, which are performed by authorized

entities in order to continuously satisfy the basic life needs of the population of a certain area.

Đerda (2006) states that communal activities include, among other things, water supply, waste water drainage, waste disposal and similar activities of local importance.

In the Republic of Croatia, the performance of utility services is regulated by the Law on Utility Management. The law prescribes the principles, the way of performing and financing the communal economy, as well as other issues of importance for the strategic management of this segment of public administration. According to Article 22 of the Act, communal activities include those activities that ensure: a) construction and/or maintenance of communal infrastructure in functional condition, b) provision of communal services that are necessary for the daily life of citizens in the area of the local self-government unit.

Utility services include the provision of public services of interest to individuals and legal entities, as well as financing the construction and maintenance of utility infrastructure at the local level (municipalities, cities, the City of Zagreb). Due to their nature, these activities are not fully subject to market laws, since their purpose cannot be achieved solely through market mechanisms (Sarvan, 2008). In this regard, Paliaga (2007) proposes partial liberalization, i.e. handing over certain segments of utility services to market entities in order to increase efficiency and improve the quality of services.

A special category within the utility economy is waste management, which is also an activity of local government units. However, this activity is defined by a special Act on Waste Management, and not by the Act on Utility Economy.

Recent literature shows that citizens' perception of utility services depends on the efficiency of the system, the transparency of the work of utility companies and the involvement of the community. Camacho-

Otero et al. (2018) emphasize the importance of changing consumer habits in a circular economy, while Schroeder et al. (2019) link circular practices with sustainable development. The OECD (2022) points out that the quality of communal services directly affects citizens' satisfaction, and the European Environment Agency (2021) notes progress in waste prevention. Pires et al. (2019) analyze the sustainable management of municipal waste in urban areas, while Van Fan et al. (2020) emphasize that the circular economy is inseparable from urban sustainability policies.

3. Research concept

In order to conduct a systematic and analytical survey of satisfaction with municipal hygiene in a city, it is necessary to design a conceptual model that encompasses key factors and their interrelationships (Figure 1).

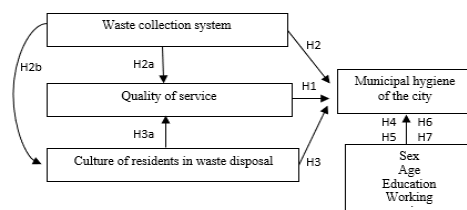


Figure 1. Conceptual model for measuring satisfaction with municipal hygiene

Based on the conceptual model, it can be concluded that the cleanliness of the city depends on: 1) the waste collection system, 2) the quality of the municipal company's services and 3) the residents' culture in disposing of waste.

The dependent variable of the model is the perception of the cleanliness of the city, while the independent variables are the waste collection system, the quality of the municipal company's services and the residents' culture in disposing of waste. The control variables are: gender, age, education and work experience of the respondents. A few sentences are devoted to each of the variables below.

Communal hygiene of the city. Communal hygiene is a part of hygiene that studies and solves problems of arrangement and maintenance of settlements with the aim of preserving and improving the health of residents. It includes all activities and measures related to the cleanliness and arrangement of public spaces, proper waste management, drinking water supply, wastewater drainage and the prevention of air, soil and water resource pollution (Brozović, 1992). The emphasis in this paper is on the collection and disposal of municipal waste.

Waste collection system. There are several different household waste collection systems. Rodrigues et al. (2016) distinguish four basic systems: a) a waste collection system using bins (bags), b) a waste collection system using containers (recycling yards), c) a waste collection system based on purchase (secondary raw materials) and d) a waste collection system based on deposits (packaging fees).

The quality of the services of a utility company is the main imperative that is set before utility companies. Citizens expect quality and new services at an affordable price, at the right time, in the right place and in the right quantity, and it can be safely stated that the quality of the services of a

utility company also depends on the municipal hygiene of the city and the creation of the prerequisites for sustainable and smart growth of cities.

The culture of residents in garbage disposal. Waste management is a key concern within the environmental protection and environmental action strategy, both in developed and developing countries, and since household waste constitutes the main part of municipal waste, the behavior and sensitivity of the population to the problem of garbage and waste are of paramount importance (Jurišić et al., 2019).

A strong culture of citizenship in waste disposal emphasizes collective responsibility, proactive participation, and community engagement to ensure environmentally sound waste management practices. This culture is built on education, trust, and the belief that each individual's actions contribute to broader environmental and social outcomes (Alipour et al., 2015).

Table 1 provides a detailed overview of the measurement constructs of the conceptual model with items and measurement scales.

Table 1. Operationalization of latent variables (author's own research)

Construct	Items	Type of ordinal measurement scale
Waste collection system	System for collecting mixed municipal waste and biodegradable waste from households using the „door-to-door“ model. (SC_DtD) System for collecting waste via a recycling yard. (SC_RY) System for collecting waste via green islands. (SC_GI). System for collecting bulky waste. (SC_BW) System for collecting waste textiles. (SC_T)	Likert agreement scale (0-5)
Quality of service of the utility company	Intensity and results of waste separation. (Intensity_RWS) Availability of garbage disposal sites. (Availability_GDS) Regularity and speed of garbage collection. (Regularity_SGC) Maintaining hygiene of the bins and containers for garbage disposal themselves. (Hygiene_BC) Cost of garbage collection and disposal. (Cost)	Likert agreement scale (0-5)
Culture of residents in waste disposal	Culture of residents in waste disposal (C_WD)	Likert agreement scale (0-5)
Municipal hygiene of the city	Municipal hygiene of the city (CHC)	Likert agreement scale (0-5)

Reliability analysis of defined constructs and items of measurement constructs was tested by calculating the values of internal consistency coefficients using Cronbach alpha coefficient. The Cronbach alpha coefficient of the items of the construct Waste collection system is 0.81, while the value of the Cronbach alpha coefficient of the items of the construct Quality of municipal services is 0.82, which indicates a high degree of internal stability and consistency of the reflective items of these two constructs

The constructs, Culture in waste disposal and City cleanliness were measured with one item each.

Accordingly, the following hypotheses were set:

H1: The quality of municipal services is directly a function of the cleanliness of the city.

H2: A developed and integrated waste collection system contributes to preserving the cleanliness of the city.

H2a: There is a positive and statistically strong relationship between the waste collection system and the quality of municipal services.

H2b: There is a positive and statistically strong relationship between the waste collection system and the culture of residents in waste disposal.

H3: The culture of residents in disposing of garbage is an important part of protecting and preserving the cleanliness of the city.

H3a: There is a positive and statistically strong relationship between the culture of residents in disposing of garbage and the

quality of municipal services.

H4: There is a statistically significant difference in satisfaction with the cleanliness of the city between men and women.

H5: There is a statistically significant difference in satisfaction with the cleanliness of the city between residents of different ages.

H6: There is a statistically significant difference in satisfaction with the cleanliness of the city between residents of different levels of education.

H7: Residents with more years of work experience show a lower level of satisfaction with the cleanliness of the city.

4. Sample

Research was conducted from May to August 2021. The targeted sample consists mostly of highly educated people, followed by people with secondary school qualifications, all of whom are resident in Rijeka, thus making the sample representative and reliable.

A survey was publicly distributed via Facebook and Facebook Groups (*Volim grad koji teče* and *Nova riječka enciklopedija – Fluminensia*). In the three months that the survey was accessible, 403 valid questionnaires were collected. The questionnaire was completed by inhabitants aged 18 to 61 and over. Only three of the 403 respondents had no work experience (Table 2).

Table 2. Demographic characteristics of respondents (author's own research)

	N	%
Sex		
Male	119	29,53
Female	284	70,47
Education		
Elementary school (ES)	-	-
Secondary school (SC)	99	24,56
Higher expertise (3 years Professional schools or Polytechnic according Bologna Declaration or 2 years according to old system of education) (HS)	45	11.17
Faculty (3 years - university baccalaureus) (F_UB)	33	8.19
Faculty (4-6 years according to old system of education) (F_OS)	121	30.02
Faculty (5 years according Bologna Declaration masters degrees) (F_MD)	61	15.14
Master of science (MSc)	12	2.98
Doctorate (PhD)	32	7.94

Age		
18-20	2	0.50
21-30	37	9.18
31-40	90	22.33
41-50	142	35.24
51-60	91	22.58
61 and more	41	10.17
Working experience		
Less than 3 years	18	4.66
3-5 years	12	2.97
5-10 years	46	11.41
10-20 years	131	32.51
More than 20 years	193	47.89
No working experience	3	0.74

5. Research results and discussion

Based on the collected data, a brief descriptive statistics of the satisfaction of the surveyed citizens with the cleanliness of the city was compiled (Table 3).

Table 3. Satisfaction with the cleanliness of the city (author's own research)

	CHC
Mean case 1-403	2.40
Median case 1-403	2- not satisfied
SD case 1-403	0.978
Valid_N case 1-403	403
Sum case 1-403	969
Min case 1-403	0 – Don't know
Max case 1-403	5 – completely satisfied
_25th% case 1-403	2- not satisfied
_75th% case 1-403	3 – partially satisfied

The average rating of citizens' satisfaction with the cleanliness of the city is very low (M=2.40; SD=0.97).

This statement is supported by the very low median value (Me=2), which means that half of the surveyed citizens are not even partially

satisfied with the cleanliness of the city.

Only 51 or 12.65% of the surveyed citizens can be said to be satisfied (47 or 11.66%) or completely satisfied (4 or 0.99%) with the cleanliness of the city.

The hypotheses set are tested below:

H1: The cleanliness of the city directly and significantly depends on the quality of the services of the utility company.

In order to determine the connection between the quality of the services of the utility company and citizens' satisfaction with the cleanliness of the city, a correlation analysis was conducted (Table 4).

Based on the data from Table 4, it can be concluded that, regarding the quality of municipal services, the citizens of the city of Rijeka are least satisfied with the intensity and results of waste separation (M=1.84; SD=0.89), while they are most satisfied with the regularity and speed of garbage collection (M=2.78; SD=1.10).

The overall average score of only 2.23 testifies to the low level of satisfaction of the citizens of the city of Rijeka with the quality of provided municipal services.

Table 4. Interdependence of the cleanliness of the city and the quality of the services of the utility company (N=403) (author's own research)

	Mean	SD	CHC (M=2.40; SD=0.97)			
			R	r ²	t	p
Intensity_RWS	1.848635	0.897435	0.40	0.16	8.77	0.00
Availability_GDS	2.627792	1.079166	0.42	0.18	9.35	0.00
Regularity_SGC	2.7866	1.103643	0.40	0.16	8.81	0.00
Hygiene_BC	1.945409	1.039995	0.43	0.19	9.67	0.00
Cost	1.942928	0.976958	0.45	20.01	10.04	0.00

Citizens rate the quality of provided municipal services with a lower average score than the cleanliness of the city itself ($M=2.23$ vs. $M=2.40$). The correlation analysis conducted confirmed the existence of a positive and statistically significant relationship between citizens' satisfaction with the cleanliness of the city and the quality of municipal services, which confirmed hypothesis H1.

H2: A developed and integrated waste collection system contributes to preserving the cleanliness of the city.

The connection between the integrated waste collection system and citizens' satisfaction with the cleanliness of the city of Rijeka was also examined using correlation analysis (Table 5).

Table 5. Interdependence of city cleanliness and waste collection system ($N=403$) (author's own research)

	Mean	SD	CHC ($M=2.40$; $SD=0.97$)			
			R	r^2	t	p
SC_DtD	1.692308	0.966923	0.263264	0.069308	5.46463	0.00
SC_RY	2.114144	1.138155	0.250992	0.062997	5.19232	0.00
SC_GI	2.081886	1.131083	0.280106	0.078460	5.84303	0.00
SC_BW	2.275434	1.133421	0.269329	0.072538	5.60025	0.00
SC_T	2.111663	1.135119	0.386915	0.149703	8.40239	0.00

Based on the data in Table 5, it can be concluded that the citizens of the city of Rijeka are least satisfied with the system for collecting mixed municipal waste and biodegradable waste from households according to the "door-to-door" model ($M=1.69$; $SD=0.96$), while they are most satisfied with the system for collecting bulky waste ($M=2.27$; $SD=1.13$). The overall average score of only 2.05 testifies to the low level of satisfaction of the citizens of the city of Rijeka with the waste collection system.

The conducted correlation analysis confirmed the existence of a positive relationship between citizens' satisfaction with the cleanliness of the city and the waste collection

system, which confirmed hypothesis H2.

H2a: There is a positive and statistically significant relationship between the waste collection system and the quality of municipal services.

A developed and integrated waste collection system is the basis for providing quality municipal services. Therefore, it is not surprising that numerous studies in the world are focused on optimizing the waste collection system (Erdelez et al., 2006). The conducted correlation analysis confirmed the existence of a positive and statistically significant relationship between the quality of municipal services and the waste collection system (Table 6).

Table 6. Correlation matrix interdependence of the quality of municipal services and the waste collection system ($N=403$) (author's own research)

	Means	Std. Dev.	I_RWS	A_GDS	R_SGS	H_BC	Cost	SC_DtD	SC_RY	SC_GI	SC_BW	SC_T
I_RWS	1.85	0.90	1.00									
A_GDS	2.63	1.08	0.41	1.00								
R_SGS	2.79	1.10	0.43	0.65	1.00							
H_BC	1.95	1.04	0.39	0.51	0.48	1.00						
Cost	1.94	0.98	0.40	0.50	0.48	0.58	1.00					
SC_DtD	1.69	0.97	0.42	0.26	0.26	0.37	0.32	1.00				
SC_RY	2.11	1.14	0.26	0.31	0.30	0.33	0.30	0.52	1.00			
SC_GI	2.08	1.13	0.32	0.33	0.33	0.42	0.40	0.47	0.66	1.00		
SC_BW	2.28	1.13	0.31	0.40	0.42	0.44	0.40	0.29	0.38	0.48	1.00	
SC_T	2.11	1.14	0.37	0.38	0.37	0.56	0.40	0.45	0.37	0.47	0.61	1.00

Based on the data in Table 6, it can be stated that the strongest relationship ($r=0.42$; $p<0.05$) is between the door-to-door waste collection system (SPO_VV) and the intensity and results of waste separation (I_ROO), and the relationship between maintaining the hygiene of the bins and containers for waste disposal and the waste collection system via the recycling yard ($r=0.33$; $p<0.05$), the relationship between maintaining the hygiene of the bins and containers for waste disposal and the waste collection system via green islands ($r=0.42$; $p<0.05$), the relationship between maintaining the hygiene of the bins and containers for waste disposal and the bulky waste collection system ($r=0.43$; $p<0.05$) and the relationship between maintaining the hygiene of the bins and containers for waste disposal and the waste textile collection system ($r=0.55$; $p<0.05$). Based on the correlation analysis, hypothesis

H2a can be accepted.

H2b: There is a positive and statistically strong relationship between the waste collection system and the residents' culture of waste disposal.

The correlation analysis shows (Table 7) that all dimensions of the waste collection system are positively and significantly related to C_WD ($p < 0.05$).

The strength of these correlations, however, varies: SC_DtD ($r = 0.412$) and SC_GI ($r = 0.333$) indicate moderate positive associations, while SC_RY ($r = 0.265$), SC_BW ($r = 0.222$), and SC_T ($r = 0.291$) show weak to moderate positive associations. Therefore, the results support the hypothesis in terms of direction and statistical significance, but the criterion of strong relationships is not fully met.

Table 7. Interdependence of the waste collection system and residents' culture of waste disposal (N=403) (author's own research)

Correlations Marked correlations are significant at $p < 0.05$ N=403 (Casewise deletion of missing data)								
	Means	Std.Dev.	SC_DtD	SC_RY	SC_GI	SC_BW	SC_T	C_WD
SC_DtD	1.692308	0.966923	1.000000					
SC_RY	2.114144	1.138155	0.515713	1.000000				
SC_GI	2.081886	1.131083	0.473448	0.657438	1.000000			
SC_BW	2.275434	1.133421	0.290886	0.378589	0.481043	1.000000		
SC_T	2.111663	1.135119	0.446136	0.369423	0.469482	0.614086	1.000000	
C_GD	1.818859	0.851946	0.412311	0.265092	0.332952	0.221823	0.291058	1.000000

The findings suggest that the waste collection system does contribute to shaping the residents' culture of waste disposal, with the door-to-door system showing the strongest association.

H3: The residents' culture of waste disposal is an important part of protecting and preserving the cleanliness of the city.

The citizens of the city of Rijeka rated the culture of their fellow citizens in waste disposal with an extremely low average score ($M=1.81$; $SD=0.85$) (Table 8).

The above statement is confirmed by the low median value ($Me=2$), but also by the fact that only the last quartile of respondents believes that the culture of residents in waste disposal deserves a rating of partially satisfactory or

higher. The obtained finding indicates the necessity of changing and strengthening the culture of residents in waste disposal.

Table 8. Ratings of the residents' culture of waste disposal (N=403) (author's own research)

	C_WD
Mean case 1-403	1.818
Median case 1-403	2- Not satisfied
SD case 1-403	0.85
Valid_N case 1-403	403
Sum case 1-403	733
MIN case 1-403	0 – Don't know
MAX case 1-403	5 – Completely satisfied
_25th% case 1-403	1 – Not at all satisfied
_75th% case 1-403	2- Not satisfied

Correlation analysis confirmed the existence of a positive and statistically significant relationship between the culture of residents

in waste disposal and the cleanliness of the city (Table 9), which confirmed hypothesis H3.

Table 9. Interdependence of the culture of residents in waste disposal and the cleanliness of the city (author's own research)

	Mean	SD	R	r ²	t	p
CHC	2.404467	0.978719				
C_WS	1.818858	0.851946	0.374488	0.140241	8.087634	0.000000

H3a: There is a positive and statistically significant relationship between the culture of residents in waste disposal and the quality of municipal services.

It is interesting that culture, in one of the etymological derivations, derives from

"agriculture" as the maintenance of natural growth (Milanja, 2012), and in this paper culture is viewed as the totality of a society's way of life (Haralambos & Holborn, 2002), more precisely the attitude towards waste and proper waste management.

Table 10. Interdependence of the culture of residents in waste disposal and the quality of municipal services (N=403) (author's own research)

	Means	SD	C_WD	I_ROO	D_MOS	R_BOS	H_BC
C_WD	1.82	0.85	1.00				
I_RWS	1.85	0.90	0.45	1.00			
A_GDS	2.63	1.08	0.41	0.41	1.00		
R_SGC	2.79	1.10	0.36	0.43	0.65	1.00	
H_BC	1.95	1.04	0.44	0.39	0.51	0.48	1.00
Cost	1.94	0.98	0.42	0.40	0.50	0.48	0.58

Based on the data in Table 10, it can be stated that the strongest relationship ($r=0.44$; $p<0.05$) is between the culture of residents in garbage disposal (C_WD) and the intensity and results of waste separation (I_RWS), and the weakest ($r=0.35$; $p<0.05$) is between the culture of residents in garbage disposal (C_WD) and the regularity and speed of garbage collection. The conducted correlation analysis confirmed hypothesis H3a.

H4: There is a statistically significant difference in satisfaction with the cleanliness of the city between men and women.

The results of the conducted t-test did not confirm hypothesis H4, and it is rejected. Namely, based on Table 11, it is evident that men and women are equally (dis)satisfied with the cleanliness of the city.

Table 11. T-test (author's own research)

T-tests; Grouping: Sex Group 1: Female Group 2: Male											
	Mean - F	Mean - M	t-value	Df	p	Valid N - F	Valid N - M	Std. Dev. - F	Std. Dev. - M	F-ratio - Var.	p - Var.
CHC	2.40	2.39	0.12	401	0.89	284	119	0.95	1.02	1.145	0.367

F – Female; M – Male

H5: There is a statistically significant difference in satisfaction with the cleanliness of the city between residents of different ages.

The results of the ANOVA analysis showed that there were significant differences in satisfaction with the cleanliness of the city

between age groups ($F(5,397) = 3.47$, $p < 0.01$).

Further analysis using the Bonferroni post hoc test revealed that respondents aged 21 to 30 years expressed significantly higher

satisfaction with cleanliness compared to the groups aged 41 to 50 years ($p = 0.028$) and 51 to 60 years ($p = 0.006$). In other comparisons between age groups, no statistically significant differences were found (Table 12).

Table 12. Bonferroni test (author's own research)

Bonferroni test; variable CHC Probabilities for Post Hoc Tests Error: Between MS = 0.93147, df = 396.00							
	Age	{1} - 1.5000	{2} - 2.8919	{3} - 2.4333	{4} - 2.3333	{5} - 2.2198	{6} - 2.6098
1	18-20		0.714874	1.000000	1.000000	1.000000	1.000000
2	21-30	0.714874		0.231281	0.027868	0.005975	1.000000
3	31-40	1.000000	0.231281		1.000000	1.000000	1.000000
4	41-50	1.000000	0.027868	1.000000		1.000000	1.000000
5	51-60	1.000000	0.005975	1.000000	1.000000		0.484530
6	61+	1.000000	1.000000	1.000000	1.000000	0.484530	

H6: There is a statistically significant difference in satisfaction with the cleanliness of the city between residents with different levels of education.

Analysis of variance (Table 13) did not reveal statistically significant differences in the level of satisfaction with the cleanliness of the city between respondents with different levels of education, and hypothesis H6 can be rejected.

H7: Residents with more years of work experience show a lower level of satisfaction with the cleanliness of the city.

No statistically significant differences were found in terms of work experience, although descriptive data indicate a decreasing trend in satisfaction with longer work experience and a lower level of satisfaction among respondents without work experience. Table 14 provides a summary of the results of the tested hypotheses.

Table 13. Relationship between satisfaction with the cleanliness of the city and the level of education of residents (author's own research)

SS; LS Means (Current effect: $F(6, 396) = 1.7029$, $p = 0.11893$ Effective hypothesis decomposition					
Education	CHC - Mean	CHC - SE	CHC - - 95.00%	CHC - +95.00%	N
Secondary school (SC)	2.28	0.09	2.09	2.47	99
Faculty (4-6 years according to old system of education) (F_OS)	2.36	0.08	2.18	2.53	121
Faculty (5 years according Bologna Declaration masters degrees) (F_MD)	2.40	0.12	2.16	2.65	61
Master of science (MSc)	2.41	0.28	1.86	2.96	12
Doctorate (PhD)	2.68	0.17	2.34	3.02	32
Higher expertise (3 years Professional schools or Polytechnic according Bologna Declaration or 2 years according to old system of education) (HS)	2.28	0.14	2.00	2.57	45
Faculty (3 years - university baccalaureus) (F_UB)	2.78	0.16	2.45	3.12	33

Table 14. Hypothesis testing results (author's own research)

Hypothesis	Results
H1: The quality of municipal services is directly a function of the cleanliness of the city.	Accepted
H2: A developed and integrated waste collection system contributes to preserving the cleanliness of the city.	Accepted
H2a: There is a positive and statistically strong relationship between the waste collection system and the quality of municipal services.	Accepted
H2b: There is a positive and statistically strong relationship between the waste collection system and the culture of residents in waste disposal.	Partially accepted
H3: The culture of residents in disposing of garbage is an important part of protecting and preserving the cleanliness of the city.	Accepted
H3a: There is a positive and statistically strong relationship between the culture of residents in disposing of garbage and the quality of municipal services.	Accepted
H4: There is a statistically significant difference in satisfaction with the cleanliness of the city between men and women.	Rejected
H5: There is a statistically significant difference in satisfaction with the cleanliness of the city between residents of different ages.	Accepted
H6: There is a statistically significant difference in satisfaction with the cleanliness of the city between residents of different levels of education.	Rejected
H7: Residents with more years of work experience show a lower level of satisfaction with the cleanliness of the city.	Rejected

6. Conclusion

The conducted research confirmed the low level of satisfaction of citizens with the cleanliness of the city, regardless of gender or professional qualifications of citizens, which places the imperative of better maintenance and waste management before the city authorities, but also all residents of the city of Rijeka. In order to improve the cleanliness of the city, it is necessary to raise the level of quality of municipal services, and above all services related to the intensity and results of waste separation. Citizens are equally dissatisfied with the maintenance of hygiene of the bins and containers for waste disposal themselves and the price of the cleaning services provided to them. As for the waste disposal system as a factor in maintaining the cleanliness of the city, it is necessary, first of

all, to work on improving the subsystem of collecting mixed municipal waste and biodegradable waste from households according to the "door-to-door" model, with which citizens are least satisfied. The culture of the residents of the city of Rijeka in waste disposal is at a very low level, which requires the undertaking of numerous measures with the aim of changing and strengthening the culture of residents in waste disposal. Practical recommendations include: (1) development of more modern waste collection systems, (2) more intensive education of citizens, and (3) digitalization of municipal processes. The limitations of the research relate to the local sample, so future research should include comparative analyses with other cities in Croatia and the EU. Overall, municipal services must be viewed within the broader framework of sustainability and the circular economy.

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